The Effect of Language on Economic Behavior: Examining the Causal Link between Future Tense and Time Preference in the Lab*

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Abstract

Since Chen (2013), a fast-growing body of literature has documented abundant supporting evidence for the linguistic-savings hypothesis. Despite this influx of research, direct causal evidence is limited. In this study, we take advantage of a unique linguistic feature of the Chinese language: speakers can freely choose whether or not to use the future tense when referring to a future event. This flexibility allows us to unobtrusively manipulate the use of "will" in the description of the rewards in a standard time preference task to cleanly examine its effect on intertemporal decisions. However, our results do not lend further empirical support for the linguistic-savings hypothesis.

Keywords: time preference, future tense, languages, linguistic-savings hypothesis

JEL Codes: C91, D15, Z13

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I. Introduction

Does the language we speak affect our thoughts, perceptions, and decision-making? This question has been asked in anthropology, philosophy, linguistics, neuroscience, and psychology for centuries. The idea was initially formulated by J. G. Herder (1744-1803) and W. V. Humboldt (1767-1835), later espoused by F. Boas (1823-1899), and further developed into the linguistic relativity hypothesis by E. Sapir (1884-1939) and B. L. Whorf (1897-1941), known as the Sapir-Whorf hypothesis. This hypothesis holds that the language structure, or grammar, embedded in the languages we speak shapes the way we think. As a result, people who speak different languages may represent physically similar states of affairs quite differently.[1] Earlier attempts aiming to test this hypothesis have found little support (see p. 20 in Krauss and Chiu 1998). More recently, several researchers have documented new evidence somewhat supporting the claim that language influences thought patterns or default modes of interpreting the world (e.g. Boroditsky 2001). However, the validity of the linguistic relativity hypothesis is still a hotly debated issue.[2]

In the field of economics, researchers have paid little attention to the effects of languages on economic decisions until recently. In an influential seminal paper with more than 400 citations in Google Scholar, M. Keith Chen (2013) hypothesizes that grammatical marking of the future makes people feel that the future is further away and, hence, they behave less patiently in various future-oriented behaviors. To test this hypothesis, Chen follows Dahl (2000) by categorizing languages according to whether a language requires its speakers to use the future tense when referring to an event in the future and finds that those who speak a "futureless" (or weak future-tense reference, hereafter weak-FTR) language save more, retire with more wealth, smoke less, practice safer sex, and are less obese than those who do not. Since then, abundant empirical evidence has provided extensive support for the linguistic-savings hypothesis (LSH) using different measures and subject pools (Falk et al. 2018; Sutter et al. 2018). Similar patterns have appeared to explain variations in individuals' political views (Pérez and

[1] For example, unlike English, Russian makes an obligatory distinction between lighter blues ("goluboy") and darker blues ("siniy"). Winawer et al. (2007) show that Russian speakers are faster at discriminating between different shades of blue.

[2] January and Kako (2007) show that several attempts to replicate the key findings in Boroditsky (2001) were unsuccessful.

Tavits 2017), pro-environmental actions (Mavisakalyan, Tarverdi, and Weber 2018), and corporations' future-oriented behaviors (Su, Tang, and Xu 2016; Kim, Kim, and Zhou 2017; Liang et al. 2018).[3]

Although these studies establish a link between linguistic markings of the future and economic behaviors, their analyses mainly rely on cross-cultural or cross-country comparison while focusing on behavioral differences between speakers of weak-FTR and strong-FTR languages. In such a setting, the observed relationship could also be driven by culture rather than the grammatical marking of the future per se. In fact, several economics studies treat "language" as a proxy for culture (Hübner and Vannoorenberghe 2015; Tabellini 2010; Licht, Goldschmidt, and Schwartz 2007). Roberts, Winters, and Chen (2015) also acknowledge that Chen's (2013) positive correlation between the future orientation of languages and the propensity to save may be overestimated because the cross-country analysis presented in that paper did not explicitly consider the interdependency among languages. Their research shows that this positive correlation still exists but becomes substantially weaker after considering the geographic and historical relatedness of languages in a cross-country empirical analysis similar to Chen (2013).

Overall, the current literature investigating the effects of language on economic behavior still lacks compelling evidence to draw a firm causal conclusion. In particular, Chen's (2013) linguistic-saving hypothesis is built on the premise that the mandatory use of future tense—distinguishing present from future—makes speakers feel that the future is further away, and therefore care less about the future; the absence of this linguistic feature mitigates this effect. This claimed mechanism driving Chen's (2013) results is yet to be examined. Given the rising importance of the LSH in economics and related disciplines, it is thus necessary to investigate the mechanism through which the use of future tense influences people's intertemporal decisions, especially in a controlled experiment.

[3] Although it is still a correlational study, Thoma and Tytus (2018) find opposing evidence. They investigate the relationship between the degree to which a language utilizes future-time reference (from the weakest to the strongest: Chinese, German, Danish, Spanish, and English) and its native speakers' intertemporal decision-making. In contrast to Chen's (2013) LSH, they find that native speakers of weaker-FTR languages exhibit a lower tendency to choose later-larger options than those of stronger-FTR languages.

Although it is natural to resort to experimental methodology to establish the causal relationship,[4] the main obstacle in doing so is that a language's grammatical rules typically constrain the use of the auxiliary verb "will," the violation of which would cause the demand or confusion effect. It is difficult to disentangle this effect from the main treatment effect we hope to uncover. In the present study, we overcome this obstacle by hinging our identification strategy on a unique linguistic feature of the Chinese language: Chinese allows its speakers to freely choose whether to use the future tense when referring to an event in the future. For example, when saying "明天我将有考试"(míng tiān wǒ jiāng yǒu kǎo shì; I will have a test tomorrow), Chinese speakers can simply omit the future-reference word "will" by saying "明天我有考试"(míng tiān wǒ yǒu kǎo shì; I have a test tomorrow).[5] The omission of "will" does not change the meaning of this sentence and is grammatically acceptable. This flexibility in the Chinese language provides us the opportunity to manipulate the use of future tense in a way that sounds natural to the subjects in order to cleanly examine its effect on intertemporal decision-making.

We recruited a total of more than 300 Chinese-speaking subjects from two research sites in Singapore and Taiwan, respectively. They made a series of intertemporal decisions between a smaller-sooner and a larger-later reward. The linguistic manipulation is unobtrusively embedded into the description of the rewards. In the future-tense (FT) condition, we described the larger-later rewards as "You will receive x dollars in y weeks," whereas in the non-future-tense (NFT) condition, the auxiliary verb "will" was omitted. Throughout the entire decision-making task, subjects in the FT condition were exposed to "will" 72 times as opposed to 0 times in the NFT condition.

Here, we would like to note that an ideal experiment to test the LSH would be: first, recruiting two randomized groups who are yet to be exposed to any language environment. Second, all the subjects from birth over the continuum of their lifetime learn a certain language, say Chinese. The only difference between the two treatment groups is the grammatical marking of future tense—mandatory in one group while discretionary in the other group. This setting would allow us to directly test if the

[4] As Roberts, Winters, and Chen (2015) suggested, experiments or case studies would be more fruitful avenues for future research on this specific topic as opposed to further large-scale cross-cultural correlational studies.

[5] As a weak-FTR language, the form of a Chinese verb never changes regardless of the tense. Chinese speakers add a time adverb and/or an aspect marker to the sentence to indicate past, present, or future.

subjects in the mandatory future tense group behave more impatiently than their discretionary counterparts, according to Chen's (2013) LSH. Obviously, this experiment is impossible to implement. Our study presents a second-best experiment whose design enables the possibility to examine whether the grammatical marking of the future tense affects decision-making to the extent that even a simple manipulation of the linguistic framing of a lab choice could alter the relative valuation of immediate and future monetary payoffs. In this sense, our experiment should be regarded as a test of the "strong-form" LSH. That said, if the data supports the alternative hypothesis, it provides strongly causal evidence for the LSH, whereas a null result does not directly refute Chen's (2013) LSH.

II. Experimental Design and the LSH Prediction

2.1 Time Preference Task

In the laboratory environment, we elicit intertemporal preferences using the multiple-price-list method (Coller and Williams 1999). The decision-making task is composed of eight rounds. In each round, subjects are presented with nine rows of binary choices between a smaller-sooner versus a larger-later monetary reward. The smaller-sooner reward is fixed at 100 tokens, while the larger-later rewards start at 110 tokens and increase by 10 tokens for each subsequent row (i.e. 110, 120, …, 190). The timings of the rewards take on different values among the eight rounds. More specifically, the timing of the earlier reward is either the present (immediate time frame) or four weeks from the present (delayed time frame). As we implement four durations of delays—1, 2, 4, and 8 weeks—the timings of the later rewards are 1, 2, 4, and 8 weeks from the present for the immediate time frame and 5, 6, 8, and 12 weeks from the present for the delayed time frame. To control for the order effect, the eight decision items are presented to the subjects in a random order, and the subjects are asked to choose a unique switch point in each round.

2.2 The Manipulation

Linguistic manipulations are naturally embedded in the description of the delayed options in the choice menu. In the FT treatment, the options are described as "I will receive y in x weeks."[6] In the NFT treatment, "will" is simply dropped. "Will"

[6] Placing a time phrase at the end of a sentence would sound unnatural to Chinese speakers. Thus, we chose to place the time phrase at the beginning of the sentence for all treatment conditions.

occurs 72 times in the FT treatment and 0 times in the NFT treatment. Both versions sound natural to Chinese speakers, eliminating any possibility of the experimenter demand effect.[7] To ensure subjects' attention to this subtle manipulation, the subjects are shown the nine rows while a sound clip, in which the options are being read aloud, is played concurrently.[8] It should also be noted that subjects heard the sound clip individually through their respective earphones which we provided specifically for this experiment, instead of hearing the sound clip being played aloud for all subjects to hear. This way, the saliency of the subtle manipulation could be enhanced. Please refer to Appendix A for the experimental instructions.[9]

In sum, our experiment features a simple linguistic manipulation on the framing of decision options. The literature on the framing effect provides ample evidence suggesting that a simple alteration in one or a few words in the decision frame presented to subjects often leads to substantial behavioral changes observed from their actual choice. In the domain of intertemporal decision-making, several studies have documented the framing effect using comparable low-key interventions (Read et al. 2005; Read, Frederick, and Scholten 2013; Fassbender et al. 2014; Breuer and Soypak 2015; Faralla, Novarese, and Ardizzone 2017). Below are a few examples of such studies. Fassbender et al. (2014) found that subjects were less patient when rewards were framed as round numbers (e.g. $11.00 today or $21.00 in 6 weeks) rather than decimal numbers (e.g. $10.87 today or $20.74 in 6 weeks). Read et al. (2005) documented the date/delay effect in the observed choice, suggesting that framing future rewards as occurring on a specific "date" (e.g. 23rd June) from the date of present rewards (e.g. 23rd December) instead of just the interval of the "delay" between present and future rewards (e.g. 6 months) lead to more patient decisions. Perhaps this is because when we describe the time intervals between the present and future rewards in terms of the duration of delays, it subtly induces people to focus on how long they will have to wait, thereby making a given delay seem longer. In contrast, when we use the exact calendar dates, it requires people to do a mental calculation to arrive at the

[7] In fact, we included a control question asking subjects to guess the purpose of the study in the second wave of Taiwan's experiment. None of the subjects correctly answered this question.
[8] We hired female recorders with voices and accents that sound natural to our participants. Hence, the sound clips used in Singapore's and Taiwan's sessions differ in accent but not content. Additionally, the sound clips used in the two treatment conditions only differ in whether or not "will" is included in the sentence.
[9] Experimental instructions used in both FT and NFT conditions were the same. We only manipulated the use of future tense in the choice list.

duration of the delay, and this makes the time interval between the present and the future rewards seem shorter than it is.

In a related study by one of the authors, though in a different domain, He (2017) manipulated the use of the first-person pronoun "I" in the description of lottery choices (e.g. "I choose where there is a 50% chance of winning 790 and a 50% chance of winning 10.") as opposed to the same statement without the pronoun "I," and found that the subtle addition of "I" caused a more than 15% increase in the degree of risk-aversion.

2.3 LSH prediction

The mechanism that Chen (2013) claimed as driving the language effect is closely related to the growing literature highlighting the role of one's mental representation of time delays in determining one's intertemporal decisions. If one perceives the passage of time to be long, he is less likely to wait to receive a larger reward. Indeed, this view is supported by several empirical investigations such as Brocas, Carrillo, and Tarrasó (2018) and Zauberman et al. (2009). As Chen (2013) postulates, a language which grammatically separates the present and the future can make users feel that the future is further away, as the mandatory use of future tense is likely to make people perceive a given time delay to be longer. Therefore, when the grammatical marker of the future, "will," is repeatedly presented to subjects, people are likely to dissociate the future from the present, thus perceiving later-larger rewards as more distant than future rewards described in the present tense. Thus, LSH predicts that subjects in the FT treatment would exhibit a lower level of patience than those in the NFT treatment.

III. Results

We conducted the experiments in Singapore and Taiwan, where the majority of the populations speak Chinese. The study recruited 159 undergraduate students at Nanyang Technological University in Singapore and 155 undergraduate students at National Taipei University in Taiwan.[10] The experiment was programmed and conducted using z-Tree (Fischbacher 2007). Table 1 summarizes the demographics of

[10] One wave of data collection was conducted in Singapore, with a total of 159 subjects recruited during the period of Feb-March 2016. Two waves were conducted in Taiwan, with 88 subjects recruited during May-June 2016 and 71 subjects recruited in Oct 2018. Notably, there was no significant difference in the average switch point chosen between these two waves (p-value=0.51 using the two-sided t-test).

the participants recruited from the two research sites. Nearly all subjects are of Chinese ethnicity. The subjects participated in the experimental session for roughly 30 minutes. After the instructions stage, subjects made the eight decisions in the time preference elicitation task, then completed a post-experiment questionnaire. Payments were made privately at the end of the session. Their earnings comprised a guaranteed participation fee and an incentive payment based on a randomly chosen decision they made in the main task. As in Andreoni and Sprenger (2012), the incentive pay was administered through a (post-dated) check for the experiment conducted in Singapore or a wire transfer for the experiment conducted in Taiwan to minimize the possible differences in transaction costs and the payment risks associated with different payment timing.[11]

[Insert Table 1 about here]

Figure 1 provides an overview of the choices our subjects made. The main variable of interest is the average switch point selected. Because subjects were asked to select a single switch point rather than make a series of binary decisions, we can rule out the possibility of having irrational decisions in the form of multiple switch points. The switch point chosen indicates the subjects' time preference.

[Insert Figure 1 about here]

Figure 1(a) provides a visual representation of the treatment effect observed in Singapore's experiment. Apparently, the average switch point chosen was not significantly different between the two treatment conditions. When using the two-sided Mann-Whitney tests, the p-values are all above 0.1 for each binary comparison. Qualitatively, in 7 out of 8 time preference items, the average switch point chosen by the FT subjects is slightly lower than that of the NFT subjects; this indicates that, in contrast to Chen's (2013) LSH, the subjects do not behave more impatiently when "will" is used repetitively.[12] In addition, we note that our subjects do not exhibit present-

[11] In order to accommodate local financial habits, we implemented different payment mechanisms at the two sites. In Singapore, somewhat similarly to the U.S., personal checking accounts are common and daily expenses can be paid with checks, whereas in Taiwan, checking accounts are mainly for corporate use and people rarely use checks as a form of payment.

[12] Although the immediate reasons why we do not find evidence supporting the LSH are: 1) virtually no mean difference between the two conditions and 2) the qualitative results even suggesting the opposite, one may worry that our sample size was too small to provide reasonable statistical power to detect differences. Based on He's (2017) study that used a similar one-word intervention and multiple-price-list method, we could expect to generate behavioral difference around 15-20%. Based on our calculation, our sample size is reasonably large enough to detect this effect size with a power of at least 0.8 at the 0.05 significant level.

biased preferences, although this is not the main subject of this study. This result is in line with several recent empirical studies that closely control transaction costs and payment reliability and fail to find a standard pattern of present bias (Andreoni and Sprenger 2012; Andersen et al. 2008).

Table 2 presents formal regression evidence on the effect of "will" on the derived measure of time preference. Our dependent variable is the minimum continuously compounded weekly interest rate that the subject requires in order to choose the later payment. Since we can only observe choices at a finite number of interest rates, we follow Benjamin, Choi, and Strickland (2010) by using an interval regression. This allows us to specify the range of values for the dependent variable. We regress subjects' required minimum weekly interest rate on experimental condition, trade-off types, and demographic controls. *Future Tense* indicates the treatment dummy, which is equal to 1 if the subject is in the FT condition. Otherwise, it takes the value of 0. Standard errors are clustered at the individual level. Column (1) confirms what we observed in Figure 1(a): subjects in the FT condition do not exhibit a lower level of patience than those in the NFT condition. In column (2), we added a few control variables into the regression analysis and found that the treatment effect remains statistically insignificant at the traditional significance level, suggesting that this study does not find further support for Chen's (2013) LSH using Singaporean subjects.

[Insert Table 2 about here]

We also investigated whether there is any dominant language effect. The concern about the dominant language effect is relevant in the Singapore context, because all Singaporeans of Chinese descent are essentially bilingual.[13] In our Singapore's experiment, we asked subjects in the exit survey to report the language (i.e. English or Mandarin or other Chinese dialects) that they were most comfortable in using. It is natural among Singaporeans that some would utilize Mandarin or other

[13] The Singapore government adopts a top-down language policy whereby the government directly influences the process of language acquisition through education policy. Each person must be conversant and proficient in his (or her) own mother tongue and English. The latter is the formal working language for communication among people of different ethnic groups, and the former is a specific language based on the person's major ethnic group. About 77% of Singaporeans are ethnically Chinese, 14% are ethnically Malay, and 8% are ethnically Indian. There are four official languages in Singapore; English as the lingua franca, Chinese, Malay, and Tamil. As a result of this bilingual policy, Singaporeans are proficient, albeit at varying degrees of proficiency, in both English and their mother tongue (see https://en.wikipedia.org/wiki/Language_planning_and_policy_in_Singapore). Participants in our Singapore sample are virtually Singaporean Chinese.

Chinese dialects more often at home and in their social circle, while some others would utilize English more. Whether Chinese is a more dominant language than English depends on the economic and social background of the family. We tested whether the subjects' dominant language (English vs. Mandarin and other Chinese dialects) had any effect on their time discounting. We included this dummy variable in our regressions and found that the coefficient is statistically insignificant.

Lastly, a caveat of Singapore's experiment is that although our subjects were instructed in Mandarin Chinese, some of them could possibly switch back to their preferred language (e.g. English) when making decisions. This could potentially bias the results. For this reason, we administered the same experiment in Taiwan, where the majority of subjects are monolingual in Chinese. We ensured that the incentive size was at least as large as it was in Singapore to enable better reliability of the results.

Figure 1(b) displays the results from the experiment conducted in Taiwan. It can be seen that our main results are largely consistent with the results obtained from the experiment in Singapore.[14] Again, the subjects in the FT condition chose a lower switch point in 7 out of 8 decisions. We cannot reject the null hypothesis that the average switch points are equal across the two treatment conditions (p-values >0.1 for each binary comparison with the exception of 1 week in the delayed time frame, for which the difference is marginally significant). Although statistically insignificant, the qualitative results show that those in the FT treatment are somewhat more patient than their counterparts in the NFT treatment. The regression results are shown in Columns (3) and (4) of Table 2. Similar to the results in Singapore, the coefficient of *Future Tense* is statistically insignificant at the traditional significance level. The negative

[14] It is notable that the average switch points chosen by Taiwanese subjects are lower than their Singaporean counterparts (p-value <0.01 using the two-sided t-test). A few factors may account for this difference. First, the conversion rates of experimental tokens into the Singapore Dollar (SGD)/New Taiwan Dollar (NTD) are 10 tokens = $1 SGD and $16.7 NTD, respectively. Based on the official exchange rate, $1 SGD was worth $23.8 NTD in the first half-year of 2016, whereas the average income in Taiwan was roughly half as much as it was in Singapore at that time (using the official 2016 per capita incomes of USD $52,961 and USD $22,497 for Singapore and Taiwan, respectively, from the World Economic Outlook Database of the International Monetary Fund). Therefore, with greater local purchasing power, the stakes for the Taiwanese subjects should have been at least as high as those for Singaporean subjects. Second, more than half of the subjects in Taiwan were economics or business majors, as our research site in Taiwan is housed in a social science/business-oriented college. It is possible that economics and business majors tend to choose a lower switch point (behave more patiently) due to their sensitivity to interest rates. This can be partially supported by the regression results in Table 2, where the coefficient *EconMajor* is significantly negative in Model 2. As a side note, during the period when we conducted the sessions, the prevailing market interest rates were similarly low in Singapore and Taiwan. For example, the 1-year CD rates were roughly 1% in both locations.

coefficient indicates that the subjects in the FT treatment, in fact, require a weekly interest rate that is 1.3% lower than those in the NFT treatments. Lastly, we performed a stronger test by pooling the data from both sites while adding a location dummy in the regression. The coefficient of *Future Tense* remains insignificantly negative. Overall, the results of the two experiments converge to suggest the absence of evidence that the repetitive use of "will" leads subjects to behave less patiently in the standard time preference elicitation task. If there is an instantaneous effect of "will" on intertemporal discounting, the qualitative results may suggest the opposite.

IV. Discussion and Conclusion

Building on the fast-growing literature showing correlations between the way a language organizes references to the future and its speakers' future-directed decisions, there is a clear need to test Chen's (2013) LSH in a well-controlled experiment to isolate the effect of language (future tense) from other potential confounding factors (culture, in particular). This study uses a within-language manipulation, capitalizing on the ability to include or omit the auxiliary "will" in Chinese; the experiment was conducted in two separate Chinese-speaking communities, providing a within-paper replication. Our experimental results do not lend further empirical support to the LSH. We find that repetitive exposure to the grammatical marker of the future, "will," does not induce subjects to behave less patiently in the time preference task.

Although readers may be tempted to interpret our results as evidence refuting the LSH, we do not hold this view. Chen (2013) and succeeding studies demonstrate the long-term effect of a language's grammatical structure on its speakers' economic preference, whereas our study focuses on the instantaneous effect of repetitive exposure to the auxiliary verb "will." As mentioned previously, our experiment should be viewed as a test of the strong-form of the LSH. According to Chen (2013), the grammatical separation between present and future would make speakers feel that the future is further away. It is possible that this process may take several years to develop, or may take place early in life as one acquires the language (as evidenced in Sutter et al. 2018), both of which could make it difficult to observe the instantaneous effect of future tense in the present experiment. Additionally, we focus solely on Chinese-speaking subjects. In our study, the subjects, regardless of the treatment condition, share the same culture and speak the same language. Although we tightly control for confounding effects from

culture, we note that there could be idiosyncratic factors mitigating the treatment effect with this design, thus requiring future research exploring this setting in other languages. Another possibility is that it may require a more intense manipulation of the decision framing in order to observe an effect, which is another area worth exploring in the future. Despite these limitations, we believe that our results contribute to economics literature in understanding the effect of future tense on people's future-oriented behaviors.

References

Andersen, Steffen, Glenn W. Harrison, Morten I. Lau, and E. Elisabet Rutström. 2008. "Eliciting Risk and Time Preferences." *Econometrica*. https://doi.org/10.1111/j.1468-0262.2008.00848.x.

Andreoni, James, and Charles Sprenger. 2012. "Risk Preferences Are Not Time Preferences." *American Economic Review* 102 (7): 3357–76. http://www.aeaweb.org/articles?id=10.1257/aer.102.7.3357.

Benjamin, Daniel J, James J Choi, and A Joshua Strickland. 2010. "Social Identity and Preferences." *American Economic Review*. https://doi.org/10.1257/aer.100.4.1913.

Boroditsky, Lera. 2001. "Does Language Shape Thought?: Mandarin and English Speakers' Conceptions of Time." *Cognitive Psychology*. https://doi.org/10.1006/cogp.2001.0748.

Breuer, Wolfgang, and K. Can Soypak. 2015. "Framing Effects in Intertemporal Choice Tasks and Financial Implications." *Journal of Economic Psychology*. https://doi.org/10.1016/j.joep.2015.09.004.

Brocas, Isabelle, Juan D Carrillo, and Jorge Tarrasó. 2018. "How Long Is a Minute?" *Games and Economic Behavior* 111: 305–22. https://doi.org/https://doi.org/10.1016/j.geb.2018.06.007.

Chen, M. Keith. 2013. "The Effect of Language on Economic Behavior: Evidence from Savings Rates, Health Behaviors, and Retirement Assets." *American Economic Review*. https://doi.org/10.1257/aer.103.2.690.

Coller, Maribeth, and Melonie B. Williams. 1999. "Eliciting Individual Discount Rates." *Experimental Economics*. https://doi.org/10.1007/BF01673482.

Dahl, Östen. 2000. "The Grammar of Future Time Reference in European Languages." In *Tense and Aspect in the Languages of Europe*, edited by Östen Dahl, 309–28. Berlin: Mouton de Gruyter. https://doi.org/10.1075/hcp.5.

Falk, Armin, Anke Becker, Thomas Dohmen, Benjamin Enke, David Huffman, and Uwe Sunde. 2018. "Global Evidence on Economic Preferences." *Quarterly Journal of Economics* 133 (4): 1645–1692. https://doi.org/10.1093/qje/qjy013.

Faralla, Valeria, Marco Novarese, and Antonella Ardizzone. 2017. “Framing Effects in Intertemporal Choice: A Nudge Experiment.” *Journal of Behavioral and Experimental Economics* . https://doi.org/10.1016/j.socec.2017.09.002.

Fassbender, Catherine, Sebastien Houde, Shayla Silver-Balbus, Kacey Ballard, Bokyung Kim, Kyle J. Rutledge, J. Faye Dixon, Ana Maria Iosif, Julie B. Schweitzer, and Samuel M. McClure. 2014. “The Decimal Effect: Behavioral and Neural Bases for a Novel Influence on Intertemporal Choice in Healthy Individuals and in ADHD.” *Journal of Cognitive Neuroscience*. https://doi.org/10.1162/jocn_a_00642.

Fischbacher, Urs. 2007. “Z-Tree: Zurich Toolbox for Ready-Made Economic Experiments.” *Experimental Economics*. https://doi.org/10.1007/s10683-006-9159-4.

He, Tai-sen. 2017. “‘I’ Make You Risk-Averse : The Effect of First-Person Pronoun Use in a Lottery Choice Experiment.” *Economics Letters* 153: 39–42.

Hübner, Malte, and Gonzague Vannoorenberghe. 2015. “Patience and Long-Run Growth.” *Economics Letters*. https://doi.org/10.1016/j.econlet.2015.10.011.

January, David, and Edward Kako. 2007. “Re-Evaluating Evidence for Linguistic Relativity: Reply to Boroditsky (2001).” *Cognition*. https://doi.org/10.1016/j.cognition.2006.07.008.

Kim, Jaehyeon, Yongtae Kim, and Jian Zhou. 2017. “Languages and Earnings Management.” *Journal of Accounting and Economics* 63 (2): 288–306. https://doi.org/https://doi.org/10.1016/j.jacceco.2017.04.001.

Krauss, Robert M, and Chi-yue Chiu. 1998. “Language and Social Behavior.” In *The Handbook of Social Psychology, Vols. 1 and 2 (4th Ed.).*, edited by D. T. Gilbert, S. T. Fiske, and G. Lindzey, 41–88. New York, NY, US: McGraw-Hill. https://doi.org/10.1162/0898929042304787.

Liang, Hao, Christopher Marquis, Luc Renneboog, and Sunny Li Sun. 2018. “Future-Time Framing: The Effect of Language on Corporate Future Orientation.” *Organization Science*, October. https://doi.org/10.1287/orsc.2018.1217.

Licht, Amir N., Chanan Goldschmidt, and Shalom H. Schwartz. 2007. “Culture Rules: The Foundations of the Rule of Law and Other Norms of Governance.”

Journal of Comparative Economics. https://doi.org/10.1016/j.jce.2007.09.001.

Mavisakalyan, Astghik, Yashar Tarverdi, and Clas Weber. 2018. "Talking in the Present, Caring for the Future: Language and Environment." *Journal of Comparative Economics*. https://doi.org/https://doi.org/10.1016/j.jce.2018.01.003.

Pérez, Efrén O, and Margit Tavits. 2017. "Language Shapes People's Time Perspective and Support for Future-Oriented Policies." *American Journal of Political Science* 61 (3): 715–27. https://doi.org/10.1111/ajps.12290.

Read, Daniel, Shane Frederick, Burcu Orsel, and Juwaria Rahman. 2005. "Four Score and Seven Years from Now: The Date/Delay Effect in Temporal Discounting." *Management Science* 51 (9): 1326–35. https://doi.org/10.1287/mnsc.1050.0412.

Read, Daniel, Shane Frederick, and Marc Scholten. 2013. "Drift: An Analysis of Outcome Framing in Intertemporal Choice." *Journal of Experimental Psychology: Learning Memory and Cognition*. https://doi.org/10.1037/a0029177.

Roberts, Seán G., James Winters, and Keith Chen. 2015. "Future Tense and Economic Decisions: Controlling for Cultural Evolution." *PLoS ONE*. https://doi.org/10.1371/journal.pone.0132145.

Su, Xunhua, Yun Tang, and Bin Xu. 2016. "Reward-Timing Uncertainty, Languages, and R&D Investment." http://www.cicfconf.org/sites/default/files/paper_523.pdf.

Sutter, Matthias, Silvia Angerer, Daniela Glätzle-Rützler, and Philipp Lergetporer. 2018. "Language Group Differences in Time Preferences: Evidence from Primary School Children in a Bilingual City." *European Economic Review* 106: 21–34. https://doi.org/https://doi.org/10.1016/j.euroecorev.2018.04.003.

Tabellini, Guido. 2010. "Culture and Institutions: Economic Development in the Regions of Europe." *Journal of the European Economic Association*. https://doi.org/10.1162/jeea_a_00001.

Thoma, Dieter, and Agnieszka E Tytus. 2018. "How Cross-Linguistic Differences in the Grammaticalization of Future Time Reference Influence Intertemporal Choices." *Cognitive Science* 42 (3): 974–1000. https://doi.org/10.1111/cogs.12525.

Winawer, J., N. Witthoft, M. C. Frank, L. Wu, A. R. Wade, and L. Boroditsky. 2007. "Russian Blues Reveal Effects of Language on Color Discrimination." *Proceedings of the National Academy of Sciences*. https://doi.org/10.1073/pnas.0701644104.

Zauberman, Gal, B Kyu Kim, Selin A Malkoc, and James R Bettman. 2009. "Discounting Time and Time Discounting: Subjective Time Perception and Intertemporal Preferences." *Journal of Marketing Research* 46 (4): 543–56. https://doi.org/10.1509/jmkr.46.4.543.

Tables and Figures

Table 1: Descriptive Statistics of Demographic Variables

	Singapore			Taiwan		
	NFT	FT	All	NFT	FT	All
Female	0.48	0.34	0.41	0.67	0.65	0.66
	(0.50)	(0.48)	(0.49)	(0.47)	(0.48)	(0.48)
Chinese	0.99	0.95	0.97	0.99	0.96	0.97
	(0.11)	(0.22)	(0.18)	(0.11)	(0.19)	(0.16)
EconMajor	0.28	0.22	0.25	0.53	0.67	0.60
	(0.45)	(0.41)	(0.43)	(0.50)	(0.47)	(0.49)
MainLanguage_Chinese	0.56	0.66	0.60	1.00	1.00	1.00
	(0.50)	(0.48)	(0.49)	(0.00)	(0.00)	(0.00)
Proficiency_English	7.95	7.93	7.94	-	-	-
	(1.35)	(1.48)	(1.40)	-	-	-
Proficiency_Chinese	8.10	8.04	8.07	-	-	-
	(1.56)	(1.97)	(1.74)	-	-	-
Frequency_English	7.78	7.39	7.62	-	-	-
	(2.24)	(2.00)	(2.15)	-	-	-
Frequency_Chinese	7.93	8.00	7.96	-	-	-
	(2.16)	(2.18)	(2.16)	-	-	-
No. of Subjects	80	79	159	76	79	155

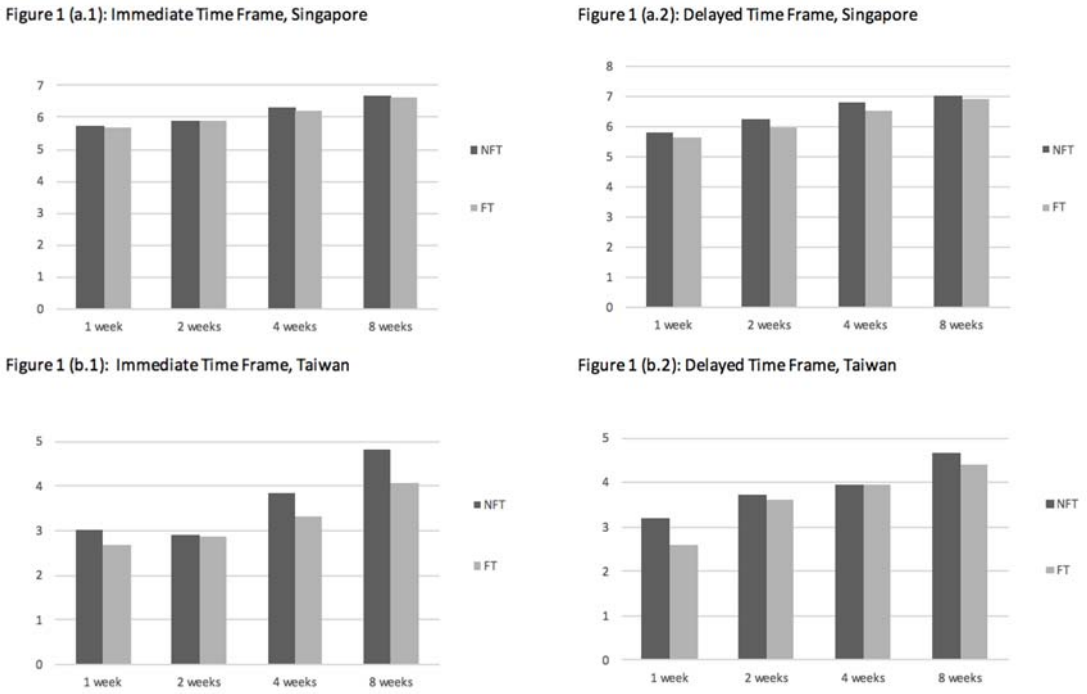
Notes: Standard deviations are reported in parentheses. Proportion tests or t-tests were used to test the difference of means. None of the means are significantly different at the 10% level with the exception of *Female* in Singapore's experiment, for which the p-value is 8.75%, and *EconMajor* in Taiwan's experiment, for which the p-value is 6.63%. *Female* is a dummy which equals 1 if the subject is female and 0 otherwise. Due to a technical glitch happened during the stage of the exit survey in a FT session with 23 subjects in Singapore, their responses in questions 5-11 were not saved successfully. As a result, the number of observations for the language-related variables is reduced from 79 to 56. *Female* is a gender dummy which equals 1 if the subject is female and 0 otherwise. *Chinese* is an ethnic dummy which equals 1 if the subject is Chinese (in Singapore's experiment)/Taiwanese (in Taiwan's experiment) and 0 otherwise. *EconMajor* is a dummy which equals 1 if the subject is an economics or business-related major and 0 otherwise. *MainLanguage_Chinese* is a dummy which equals 1 if the subject's main language is Mandarin or other Chinese dialects and 0 otherwise. *Proficiency_English* is the subject's self-reported proficiency in English on a scale between 1 (not proficient at all) to 10 (very proficient). *Proficiency_Chinese* is the subject's self-reported proficiency in Mandarin Chinese on a scale between 1 (not proficient at all) to 10 (very proficient). *Frequency_English* is the subject's self-reported frequency of using English on a scale between 1 (rarely) to 10 (very often). *Frequency_Chinese* is the subject's self-reported frequency of using Mandarin Chinese on a scale between 1 (rarely) to 10 (very often). Due to the monolingual nature of Taiwanese subjects, questions 8-11 were not included in the exit survey.

Table 2: Interval Regressions

	Singapore		Taiwan	
	(1)	(2)	(3)	(4)
Future Tense	-0.0043	-0.0068	-0.0132	-0.0132
	(0.0133)	(0.0129)	(0.0112)	(0.0113)
Time Interval		-0.0409***		-0.0195***
		(0.0018)		(0.0014)
Immediate Time Frame		-0.0053		-0.0104***
		(0.0046)		(0.0037)
Female		-0.0020		-0.0153
		(0.0133)		(0.0126)
EconMajor		-0.0469***		-0.0022
		(0.0149)		(0.0119)
Constant	0.1960***	0.3640***	0.1098***	0.2010***
	(0.0091)	(0.0152)	(0.0105)	(0.0161)
No. of clusters	159	159	155	155
No. of obs.	1272	1272	1240	1240

Notes: The dependent variable is the minimum continuously compounded weekly interest rate that the subject requires to choose the later payment. Robust standard errors are reported in parentheses. Standard errors are clustered at the individual level. *Future Tense* is the treatment dummy which equals 1 if the subject is the FT condition and 0 otherwise. *Time Interval* indicates the duration of delay in weeks. *Immediate Time Frame* is a dummy which equals 1 if the earlier-smaller reward is at present and 0 otherwise. *Female* is a dummy which equals 1 if the subject is female and 0 otherwise; *EconMajor* is a dummy which equals 1 if the subject is an economics or business-related major and 0 otherwise. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure 1: Comparison of the Average Switching Point by Treatment Conditions



Notes: Figure 1 (a.1) illustrates the average switch points chosen under the immediate time frame for the experiment conducted in Singapore, while Figure 1 (a.2) illustrates the same information under the delayed time frame. Similarly, Figure 1 (b.1) and Figure 1 (b.2) illustrate the average switch points chosen under the immediate and delayed time frames, respectively, for the experiment conducted in Taiwan. NFT and FT denote the "No Future Tense" and "Future Tense" treatment conditions, respectively. Two-sided Mann-Whitney tests were used to examine the difference of means between the two treatment conditions for each of the 16 binary comparisons. None of the means are significantly different at the 10% level with the exception of 1 week in the delayed time frame in Taiwan's experiment, for which the difference is marginally significant.

Appendix A: Experimental Instructions, Main Task, and Exit Survey

A.1 Experimental Instructions

Thanks for your participation. This session consists of the main task and a questionnaire. I expect the whole session to take about 30 minutes. Depending on your decisions and luck, you will be able to earn a sum of money in addition to the $3 guaranteed for your participation. Please read the following instructions carefully.

NO communication between participants is allowed at any time during the experiment. If you have any questions, please raise your hand and I will come to assist you privately. Please now turn off your mobile phone and any other electronic devices. These must remain off until you leave this room.

During the experiment, your earnings will be calculated in "tokens." You will be paid in Singapore dollars at the following conversion rate:

10 tokens = S$1

To ensure anonymity, your decisions in this session are linked to your Participant ID number and at the end of this session you will be paid by Participant ID number. All payments will be put in an envelope. No other participants will see how much you have been paid. Please do not reveal your choices to any other participant in the experiment.

Task

This task consists of 8 rounds. In each round, you will make a series of decisions on choosing between two payments with different time frames. One is earlier than the other but the latter entails a larger amount.

In each round, you will be presented with 9 rows. An example of the options presented in a round is shown as the table below:

You will be asked to choose between 100 paid today versus a larger amount in the future. The options presented to you are increased by 10 tokens in each of the following rows. In each round, you will be asked to choose the "switch point." For example, if your preferred choice of switch point is 3, this indicates that you would not switch to the delayed payment unless the amount is equal or greater than 130.

The 9 rows will be shown to you while a sound clip in which the options are being read aloud will be played concurrently. You will make the decision after the sound clip is finished. Please read and listen carefully to the options presented to you before making a decision.

Example

In each of the following row, you are choosing between a fixed amount of:

100 tokens paid today

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in x weeks.
2	I will receive 120 in x weeks.
3	I will receive 130 in x weeks.
4	I will receive 140 in x weeks.
5	I will receive 150 in x weeks.
6	I will receive 160 in x weeks.
7	I will receive 170 in x weeks.
8	I will receive 180 in x weeks.
9	I will receive 190 in x weeks.

<continue>

Payment

After you finish making your decisions in all the 8 rounds, one decision will be randomly selected for payment. The amount and the timing of your payment will depend on the option you have chosen in this randomly selected decision. For example, suppose that your preferred switch point is 5. If the decision in the third row

is selected for payment, you will be paid 100 tokens today. Since you would switch after row 5, your decision in the third row is to receive 100 tokens today. Therefore, your earnings would be 100 tokens paid today. However, if the decision in the sixth row is selected for payment, you will be paid 160 tokens in x weeks. Since you would switch after row 5, your decision in the sixth row is to receive 160 tokens in x weeks. Therefore, your earnings would be 160 tokens paid in x weeks.

Your payment will be made in checks. If the timing of the payment is on a future date, this check will be post-dated and you cannot cash the check until then. If the timing of the payment is today, the check will be dated today and you can cash the check from today onwards. The earnings will be converted to Singapore dollars using the 10 tokens = S$1 conversion rate. The $3 participation fee will be paid to you in cash.

Example
In each of the following row, you are choosing between a fixed amount of:

100 tokens paid today

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in x weeks.
2	I will receive 120 in x weeks.
3	I will receive 130 in x weeks.
4	I will receive 140 in x weeks.
5	I will receive 150 in x weeks.
6	I will receive 160 in x weeks.
7	I will receive 170 in x weeks.
8	I will receive 180 in x weeks.
9	I will receive 190 in x weeks.

<continue>

Please raise your hand if you have any questions. Press OK whenever you are ready to start.

<OK>

A.2 Main Task

The main task consists of 8 decision items which are presented in a random order to the subjects. We illustrates an example below.

Period 1:

In each of the following row, you are choosing between a fixed amount of:

100 tokens paid today

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in 1 week(s).
2	I will receive 120 in 1 week(s).
3	I will receive 130 in 1 week(s).
4	I will receive 140 in 1 week(s).
5	I will receive 150 in 1 week(s).
6	I will receive 160 in 1 week(s).
7	I will receive 170 in 1 week(s).
8	I will receive 180 in 1 week(s).
9	I will receive 190 in 1 week(s).

<continue>

Period 2:

In each of the following row, you are choosing between a fixed amount of:

100 tokens paid today

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in 2 week(s).
2	I will receive 120 in 2 week(s).
3	I will receive 130 in 2 week(s).
4	I will receive 140 in 2 week(s).
5	I will receive 150 in 2 week(s).
6	I will receive 160 in 2 week(s).
7	I will receive 170 in 2 week(s).
8	I will receive 180 in 2 week(s).
9	I will receive 190 in 2 week(s).

<continue>

Period 3:

In each of the following row, you are choosing between a fixed amount of:

100 tokens paid today

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in 4 week(s).
2	I will receive 120 in 4 week(s).
3	I will receive 130 in 4 week(s).
4	I will receive 140 in 4 week(s).
5	I will receive 150 in 4 week(s).
6	I will receive 160 in 4 week(s).
7	I will receive 170 in 4 week(s).
8	I will receive 180 in 4 week(s).
9	I will receive 190 in 4 week(s).

<continue>

Period 4:

In each of the following row, you are choosing between a fixed amount of:

100 tokens paid today

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in 8 week(s).
2	I will receive 120 in 8 week(s).
3	I will receive 130 in 8 week(s).
4	I will receive 140 in 8 week(s).
5	I will receive 150 in 8 week(s).
6	I will receive 160 in 8 week(s).
7	I will receive 170 in 8 week(s).
8	I will receive 180 in 8 week(s).
9	I will receive 190 in 8 week(s).

<continue>

Period 5:

In each of the following row, you are choosing between a fixed amount of:

100 tokens paid in 4 weeks

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in 5 week(s).
2	I will receive 120 in 5 week(s).
3	I will receive 130 in 5 week(s).
4	I will receive 140 in 5 week(s).
5	I will receive 150 in 5 week(s).
6	I will receive 160 in 5 week(s).
7	I will receive 170 in 5 week(s).
8	I will receive 180 in 5 week(s).
9	I will receive 190 in 5 week(s).

<continue>

Period 6:

In each of the following row, you are choosing between a fixed amount of:

100 tokens paid in 4 weeks

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in 6 week(s).
2	I will receive 120 in 6 week(s).
3	I will receive 130 in 6 week(s).
4	I will receive 140 in 6 week(s).
5	I will receive 150 in 6 week(s).
6	I will receive 160 in 6 week(s).
7	I will receive 170 in 6 week(s).
8	I will receive 180 in 6 week(s).
9	I will receive 190 in 6 week(s).

<continue>

Period 7:

In each of the following row, you are choosing between a fixed amount of:

100 tokens paid in 4 weeks

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in 8 week(s).
2	I will receive 120 in 8 week(s).
3	I will receive 130 in 8 week(s).
4	I will receive 140 in 8 week(s).
5	I will receive 150 in 8 week(s).
6	I will receive 160 in 8 week(s).
7	I will receive 170 in 8 week(s).
8	I will receive 180 in 8 week(s).
9	I will receive 190 in 8 week(s).

<continue>

Period 8:

In each of the following row, you are choosing between a fixed amount of:

100 tokens paid in 4 weeks

versus a larger but delayed amount paid in a future time.

Please listen to the sound clip and you will be asked to select your preferred switch point.

	Decision
1	I will receive 110 in 12 week(s).
2	I will receive 120 in 12 week(s).
3	I will receive 130 in 12 week(s).
4	I will receive 140 in 12 week(s).
5	I will receive 150 in 12 week(s).
6	I will receive 160 in 12 week(s).
7	I will receive 170 in 12 week(s).
8	I will receive 180 in 12 week(s).
9	I will receive 190 in 12 week(s).

<continue>

A.3 Exit Survey

1. Are you?
Male
Female

2. Are you (please check all that apply)?
Caucasian
Chinese
Indian
Malay
Others

3. Are you an Economics or Business major?
Yes
No

4. Are you in Year?
1
2
3
4

5. What is your immigration status?
Singapore Citizen
Permanent Resident
Foreigner

6. Are you?
Singaporean Chinese
Malaysian Chinese
Mainland Chinese
Others

Please specify if you answer Others

7. Which language would best express yourself (are you most comfortable in using)?
English
Mandarin
Hokkien
Teochew
Cantonese
Other Chinese dialect
Other language

8. Please rate your proficiency in English on a scale of 1(not proficient at all) to 10(very proficient)

9. Please rate your proficiency in Mandarin on a scale of 1(not proficient at all) to 10(very proficient)

10. How often do you use English in your daily life on a scale of 1(very rare) to 10(very often)?

11. How often do you use Mandarin in your daily life on a scale of 1(very rare) to 10(very often)?